

## CLAIMS

What is claimed is:

- 5     app11. An apparatus for facilitating cavitation in fluids, the apparatus comprising:  
        a housing having a generally hollow interior, the housing defining a first  
                opening for receiving a shaft;  
  
        a rotor disposed within the hollow interior of the housing, the rotor adapted to  
10                 couple with a shaft, the rotor having an exterior surface, the rotor  
                defining a first opening disposed on the exterior surface and a second  
                opening with a fluid passage extending therebetween, wherein the fluid  
                passage facilitates cavitation in a fluid.
- 15     2.         The apparatus of claim 1, wherein the housing defines a fluid ingress opening  
                and a fluid egress opening, and the rotor includes a front face and an opposed rear  
                face with a longitudinal exterior surface extending therebetween, wherein the front  
                face defines a void extending rearward toward the rear face, the rotor defining a fluid  
                passage extending generally outward from the void to the longitudinal exterior  
20                 surface, wherein responsive to rotation of the rotor and fluid flowing through fluid  
                passage in the rotor, cavitation occurs in the fluid.
3.         The apparatus of claim 2, wherein the fluid ingress opening is aligned with the  
                void of the rotor such that fluid flowing from the fluid ingress opening is received by  
25                 the void.
4.         The apparatus of claim 2, wherein the fluid engress opening is aligned with the  
                void of the rotor such that fluid flowing from the void is received by the fluid egress.
- 30     5.         The apparatus of claim 2, wherein a given opening selected from a set of  
                openings consisting of the fluid ingress opening and the fluid egress opening is  
                generally aligned with the void, and further including:  
                a fluid seal abutting the rotor, the fluid seal generally aligned with the void  
                        and the given opening, wherein the fluid seal substantially

communicates direct fluid flow between the given opening and the void.

- 5    6.    The apparatus of claim 5, further including:  
a pipe received by the given opening, the pipe extending at least partially into  
the hollow interior of the housing.
7.    The apparatus of claim 6, wherein the front face of the rotor defines a notch  
10    extending around the circumference of the void, wherein the fluid seal fixedly abuts  
the notch and extends therefrom to the pipe.
8.    The apparatus of claim 2, wherein the fluid passage includes a point of  
minimal clearance such that on one side of the point fluid in the fluid passage is at a  
15    higher pressure than fluid on the opposite side of the point.
9.    The apparatus of claim 2, wherein the housing includes a front face having the  
fluid ingress and egress openings formed therein.
- 20    10.    The apparatus of claim 2, further including:  
a shaft defining a hollow interior in communication with the void, wherein a  
non-fluid flows either into or out of the housing via the hollow shaft.
11.    The apparatus of claim 2, wherein the housing includes a face plate and a base  
25    portion, wherein the face plate defines only one opening for providing fluid flow, the  
one opening being either the fluid ingress or the fluid egress opening.
12.    The apparatus of claim 2, wherein the housing includes a face plate and a base  
portion, wherein the face plate defines multiple openings for providing fluid flow, the  
30    multiple openings including the fluid ingress opening and the fluid egress opening.
13.    The apparatus of claim 2, further including:

a restrictive element disposed in the fluid passage, wherein fluid in the fluid pressure on one side of the restrictive element is at a higher pressure than fluid on the opposite side of the restrictive element.

5 14. The apparatus of claim 13, further including:

a second restrictive element disposed in the fluid passage, wherein fluid in the fluid passage on one side of the second restrictive element is at a higher pressure than fluid on the opposite side of the second restrictive element.

10 15. The apparatus of claim 13, further including:

a restrictive element biaser adapted to bias the restrictive element such that fluid flow past the restrictive element is approximately at a predetermined value.

15 16. The apparatus of claim 2, wherein the housing includes a base portion and a face plate, the base portion having an inner wall defining the hollow interior of the housing, and the inner wall defines a circumferential trough about the rotor.

17. The apparatus of claim 2, wherein fluid flows into the void of the rotor,  
20 through the passage of the rotor, and into the circumferential trough, wherein responsive to spinning of the rotor and fluid flowing through the apparatus, the fluid in the circumferential trough spins about an axis defined by the rotor, the spinning fluid having a pressure gradient with maximum pressure distal from the rotor.

25 18. The apparatus of claim 2, further including:

a transducer disposed within the housing, the transducer adapted to emit ultrasonic energy into the cavity.

19. The apparatus of claim 18, wherein the transducer is affixed to the rotor.

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20. The apparatus of claim 2, further including:

a volute ring circumferentially disposed around the rotor, the volute ring adapted to spin about an axis and receive fluid from the rotor, wherein responsive to the volute ring spinning about the axis and having a fluid

therein, the fluid develops a pressure gradient with maximum pressure distal from the axis.

5     21.     The apparatus of claim 1, wherein the rotor defines a front face and an  
opposed rear face, the exterior surface extends longitudinally between the opposed  
front and rear faces, and wherein the second opening is disposed on the exterior  
surface, the passage extending inward from the first opening to a given point within  
the rotor and then extending outward from the given point to the second opening.

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22.     The apparatus of claim 1, wherein the rotor defines a front face and an  
opposed rear face, the exterior surface extends longitudinally between the opposed  
front and rear faces, wherein the second opening is disposed on the front face.

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23.     An apparatus for creating vapor bubbles in a fluid, the apparatus comprising:  
a rotor having a front face and an opposed rear face and having an exterior  
surface extending longitudinally therebetween, the rotor defining a  
20             plurality of irregularly spaced cavities disposed on the longitudinal  
exterior surface.

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24.     An apparatus for facilitating creation of cavitation in fluids, the apparatus  
comprised of:

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a base having a rear wall and a longitudinal wall, the rear wall and  
longitudinal wall each having an interior side and an exterior side,  
wherein the longitudinal wall extends from the rear wall such that the  
interior side of the rear wall and the interior side of the longitudinal  
wall define a cavity, the rear wall having an opening extending from  
30             the interior side to the exterior side for receiving a shaft;

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a face plate having an exterior side and an interior side, the face plate  
removably mounted to the base plate with the interior side of the face  
plate facing towards the cavity, wherein the face plate defines a first  
fluidic passage;

5 a rotor disposed within the cavity, the rotor having a front face, an opposed rear face, and a surface extending therebetween, the face plate defining a void for receiving a fluid, the void extending rearward into the rotor, the rotor defining a second fluid passage, the second fluid passage extending between the void and the exterior surface of the rotor, the second fluid passage for communicating a fluid between the void and the cavity; and

10 a sealing element abutting the face of the rotor, wherein the sealing element, the void, and the first passage define a first fluidic region, wherein a second fluidic region is defined by the region of the cavity exterior to the rotor and the sealing element, wherein fluid is communicated between the first fluidic region and the second fluidic region via the second fluid passage and the sealing element substantially prevents direct communication of fluid between the first and second fluidic regions.

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25. A method for facilitating cavitation in a fluid, the method comprising the steps of:

20 providing a fluid;  
inducing tensile stress in the fluid for facilitating controlled cavitation through rotation.

26. The method of claim 25, further including the step of:  
controlling the collapse of vapor bubbles formed during cavitation.

25 27. The method of claim 25, further including the steps of:  
inducing a change in pressure in the fluid for further facilitating cavitation.

28. The method of claim 25, further including the step of:  
communicating the fluid into a passage of a rotor;  
30 spinning the rotor disposed in the apparatus, wherein the spinning rotor rotates the fluid therein.